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EQUIPMENT OF THE MANILA OBSERVATORY.

It is well known that the Manila Observatory enjoys a well-earned reputation because of its accurate reports and weather forecasts. However, as few men in America have an accurate or extensive knowledge of the instruments used by the Observatory staff, it is the purpose of the writer to give a brief description of the equipment for the benefit of the BULLETIN readers.

The Observatory is the Central Office of the Weather Bureau. Every day a weather forecast is published and, when there is a typhoon in the vicinity, warnings are also given to the public as often as it is necessary. To obtain this information, a daily weather map is made out. All observations required for this map are sent to the Observatory directly from the central postoffice (in charge of the telegraph system of the Islands) to the telegraph operator in the Observatory. These telegrams come from forty-two stations in the Islands and twenty-six stations in China, Indo-China and Japan. Information is received from observations of "atmospheric pressure; temperature; direction and force of the wind; amount, form, and direction of upper and lower clouds; state of the sea and weather; rainfall; earthquakes, of any occur shortly before or after the time of the reported observations; the maximum and minimum temperatures" (copied from "Practical Instructions and Regulations for the Observers of the Weather Bureau"). This shows the nature of the equipment of the stations. The Central Office takes care of the maintenance of these instruments and of requisitions for material used at these stations. A staff of men is employed for adjusting and repairing all instruments that do not function properly. At the Observatory itself, the instruments used for the daily observations are very interesting. There are eleven mercurial barometers, all of the best quality, and purchased in England, France and America. The French instruments are used for daily observations; the others used for comparing and testing. There are five anemometers, two made in England, one in France and three from America, the latter being the same as those used by the U.S. Weather Bureau. There are rain gauges, both recording and direct observing. Thermometers, both maximum and minimum, like those at Woodstock, have their place here. An interesting instrument is the recording wet-and-dry-bulb thermometers made by Richard of Paris. Daily observations are taken of the ground at various depths. The amount of evaporation is measured with an atidometer, (a graduated tube, filled with water, inverted and its lower end covered with special blotting paper.) At Manila and a few other stations, the Quadruple Register, an instrument used by the U.S. Weather Bureau, is installed. It is an instrument that on one sheet of paper, gives a continuous record of wind velocity, wind direction, rainfall and duration of sunshine. These are some of the instruments in use at the present time, a great contrast to an old and venerable piece of apparatus in their midst. This is a Universal Meteorograph, designed by Father Secchi and purchased by Fr. Faura in 1868. This instrument has two sheets of paper on which to record various phenomena. Temperature, pressure, direction of wind, velocity of wind and rainfall are recorded on one sheet; pressure; temperature & on a scale five times larger than on the other sheet),

(Reprint)

humidity of the air and time of rainfall are recorded on the second sheet. This instrument, in its day, was a marvel and was the forerunner of modern recording instruments. A similar instrument is kept in one of our Colleges at Cincinnati. This is not a complete enumeration of the instruments of the meteorological department, but, even though it is somewhat general and rather brief, it shows why the quality of the work done in this most important department of the Observatory is of a high standard.

The instruments of the astronomical department are of the same quality as those in the meteorological department, but they are also more spectacular. The most imposing piece of apparatus is the large equatorial telescope. It is a refracting telescope, with an objective of 46 cm. in diameter, with a focal length of seven meters, the handiwork of the German optician, Merz. The mounting and clock movement was made by Geo. W. Saegmuller, Washington, D.C., in 1892. Besides the eyepieces (one of which is fitted with a prism for horizontal observing), colored glasses and filter micrometer (which can be used only in a direction E-W), there are two spectroscopes which can be attached to the telescope. One of these, made by Vogel, is for use on the telescope alone. The other spectroscope, made by A. Hilger, may be used on the telescope or independently. Its prism is in the form of an equilateral triangular prism, 11 cm. on each side of the base and 7 cm. in height. Instead of the prism, a plane diffraction grating, on a special mounting, may be used. The value of this grating, 8 cm. by 5 cm. in size, is evident from these inscriptions scratched on the metal: "Ruled on Prof. Rowland's Engine, John Hopkins University, Baltimore Md. U.S.A., 1892"; "Plate prepared at the Astronomical and Physical Instrument works of J.H. Brasher, Allegheny, Pa., U.S.A."; "14438 lines to one inch, 568 lines to one mm." Both of these spectroscopes have attachments for spectra as well as eyepieces for direct viewing of the spectra. For direct measurement of the distances between lines, a micrometer is supplied, but its use is restricted to the E-W direction. There are special micrometers for measuring spaces on photographs of spectra, one of which can measure directly (with a vernier attachment) to 1/1000 of a mm. The instruments for determining the time are excellent. A meridian telescope, made by A. Repsold & Sohne, Hamburg, and purchased in 1915, is used to determine the rate of Kiefler Precision Siderial Clock. The meridian telescope is a "broken" telescope, that is, with a prism to reflect the light at right angles to the axis of telescope thus enabling the observer to see the image of the star through the hollow horizontal axle of the telescope. The instrument has the usual reversing attachment found on Repsold instruments and also has a special attachment between the level parallel to the horizontal axle and the telescope for determining latitude by the Horrebow-Talcott method. One division of the level tube parallel to the horizontal axle equals 1.37" of arc and the value of the micrometer screw thread is 87.338" of arc. The rate of the Kiefler Clock is seldom over 0.10 seconds per day (gaining) whereas its usual rate is 0.03, 0.04, 0.05 seconds per day. There is also a Kiefler Clock for civil time. The clocks used before the acquisition of the Kiefler clocks are still used and are very reliable. A standard clock for time signals is regulated according to the Kiefler clock and at 10:55 A.M., signals are sent to all the post office stations throughout the Islands, the post-office department being in charge of all telegraph communication. At 9:55 P.M. the signals are sent to the stations open to receive them. At both times, the signals are relayed to Cavite and transmitted by wireless to ships and other receiving stations. Chronometers are rated and adjusted at the Observatory for use on shipboard. The equipment of the astronomical department places the Observatory in a very advantageous position for astronomical work, as there is no other observatory in the Far East with equipment to equal it.

Another department that has attracted the attention of scientific men is the magnetic division. Due to the proximity of electric light wires and especially to the car line adjoining the property, the magnetic instruments were moved from the Observatory to a special building at Antipolo, about fifteen miles from Manila.

The purpose of the magnetic department is to determine the value of magnetic declination in all parts of the Islands, an object practically attained before the American occupation and with the instruments at Antipolo, to determine the variations of magnetic intensity together with the horizontal and vertical components of the same. Variations of the magnetic declination are also observed and measured. The instruments at Antipolo are photographic and give a continuous record of the variations. The position of the Observatory near the magnetic equator gives a very favorable opportunity for these investigations. When the Carnegie, the non-magnetic ship touring the world in connection with magnetic research work, visited Manila, a comparison of the instruments at Antipolo with the instruments on the Carnegie confirmed the reliability and confidence placed in the equipment.

The seismological instruments are complete and an enumeration of the various pieces of apparatus in the order in which they have been acquired will show the policy of the Observatory and give an idea of the work it has done.

Before 1880. Two simple pendulums, with points for indicating the movements of the earth on the concave surfaces of spheres over which they are suspended, formed the seismological equipment. The study and publication of the records of these "seismographs" after the destructive earthquake of 1880 drew much attention to Fr. Faura.

1881. A microseismometer of "Tronometric pendulum", an instrument designed by Bertelli, was acquired. In the same year, two seismographs, designed by Fr. Secchi were bought. One is called "Sismografo Cecchi"; the other, "Microsismografo Registrador."

1884. A "Sismoscopio de Rossi" was purchased. Another seismograph of Fr. Secchi's was added to the equipment this year.

Sometime between 1884 and 1902, a Gray-Milne seismograph was acquired. All of the above instruments have only an historical interest now. The instruments in use are the following.

1902. A Vicentini Universal Microseismograph took its place in the Observatory. The name plate reads: - "Microsismografo Vicentine, A. Gagnato, meccanico dell'istituto Fisico, P. Università Padua." The vertical pendulum is 100 kgm. in weight; another weight, (about one half the volume of the larger pendulum, probably 50 kgm. in weight) is suspended by a strong steel "spring" for recording vertical movements. Horizontal movements are magnified 100 times, vertical movements 112 times.

1906. A seismograph, modeled according to the Omori seismograph, was constructed in the Observatory. It magnifies about 6 times.

1911. A Wiecheart inverted-pendulum seismograph, made by G. Bartels, Göttingen, was purchased. The weight of the steady mass is one ton and the movements are magnified 500 times. It records only E-W and N-S movements.

These instruments show that the Observatory has kept up to date and has studied seismic phenomena in the best manner possible.

A few instruments not classified in any of the above departments, are the pyrheliometers and the apparatus for measuring the height of clouds. The Observatory possesses an Angstrom pyrheliometer and an Abbot Silverdisk pyrheliometer. Mention should be made of Father Algue's invention for measuring the velocity of clouds and also his transit telescope for obtaining the transits of stars by photography.

This brief description of the equipment is not complete nor detailed. It claims, however, that it gives a definite idea of the main instrumental equipment utilized by the Observatory staff, more certain knowledge of the activities of the various departments and gives one reason for the well known thoroughness and accuracy of the work done at the Manila Observatory.

Bernard F. Doucette, S. J.

Manila, Philippine Islands.

PHOTOGRAPHIC NOTES IV.

An unavoidable underexposure can scarcely take place in the studio, but it may occur outside and consequently a developer that will coax everything out of a plate or film may be worth noting. The following formula was worked out in the Eastman laboratory and the resulting solution is intended to develop an underexposed plate or film very quickly. Fast plates give a grained image and still more grained if kept in the developer a long time.

Metol 140 grains.
 Hydroquinone 120 grains
 Sodium Sulphite (dry) 1 1/2 oz.
 Potass. Bromide 8H grains.
 Sodium Hydroxide 35 grains.
 Water 20 oz (fluid).
 Methyl Alcohol 1 oz (fluid).

The best way of getting the various ingredients in solution is the following: take 18 oz. of very hot water, add the Sulphite; when this is dissolved add the Metol and Hydroquinone. Save the Bromide and Sodium Hydroxide dissolved in 2 oz. cold water; add this to the first solution and when the whole has cooled add 1 oz. of Methyl Alcohol. This solution should be made up when it is to be used, not long before.

One special exposure should also be explained. It may be necessary to make a slide of a plain black line map or diagram printed on white paper, 24 inches or more on the side. The lines in a well made map are rather fine, varying from 1/50 to 1/100 of an inch in width. If one were to make a negative, slide size, directly of such a diagram, these lines would be brought down to about 1/8 of their width, showing on the ground glass and sensitive plate as very thin lines 1/400 or 1/800 of an inch wide. Now when the light waves beat on the emulsion of the sensitive plate, they do not merely sweep through the film perpendicularly to the plate but they also act laterally, due to the scattering action of the particles in the emulsion. So we should have a thin line on the surface of the plate, say 1/500 of an inch wide, attacked on both sides by surging light waves. Moreover, some of the light which penetrates the film is reflected from the back of the plate and these new waves tend also to flood the defenseless line. This last effect, from reflection, with a given illumination on the subject and a given transparency of emulsion, will vary with the thickness of the emulsion carrier, being greater with thick glass and less with thin celluloid. It may be avoided by "backing" the plates. But the lateral light action, more fatal to very thin lines or small dots, will always take place. So this seems to be the best solution of the problem: do not reduce the diagram to slide size directly; make it at least six inches square. Use a slow "cut film", say a "process" film, give a correct exposure and develop just to the point of shading the lines which should be clear on the negative. In this way, the lines will remain open, and points only 1/50 of an inch apart on the subject will not fuse together on the plate. If the resultant negative is not strong enough, intensify it (to be explained immediately) and make the slide by camera reduction.

Let us now suppose we have a set of negatives, all of proper size for slide making by contact printing. They must first be sorted for "treatment".

All negatives from line work should be harsh, i.e. high in contrast, the lights of the subject very dense on the plate and the blacks practically clear glass. From such negatives you will make clean hard slide, good to look at and easy on the eyes. Natural object negatives or those having continuous shading, should have moderate strength, fair contrast and full detail. If the line negatives are weak and the natural object negatives lack the needed contrast, both classes should be intensified. By this means, contrast is heightened.

One very simple process, harmless to negatives, and working moderately well, is this: soak the negative in cold water for half an hour, then place

it in a tray containing 3 or 4 oz. of water to which a "teaspoonful" of red ink has been added; rock for 5 minutes, drain, and without washing, place on the rack to dry. A more formal and stronger intensifier is the following, in two solutions:

- (A.) Mercury Bichloride 600 grains.
Ammonium Chloride 600 grains.
Water 30 fl. oz.

This may be kept in stock. For actual work, fill an 8 oz. bottle from the stock and use this over and over again till it becomes cloudy or weak.

- (B.) Ammonium Hydroxide (Conc. sol.) 1 oz.
Water 8 oz.

This also may be used over and over again.

Procedure: be sure that the negative to be treated has been properly "fixed" and washed, otherwise, staining may result. Immerse the dry negative in 4 oz. of (A) and rock until the black silver deposit becomes white; remove the plate and place it in running water for at least 5 minutes. Then put it in another tray which contains (B). Rock the tray till the whitened image turns black, remove and wash for 3 or 4 minutes and place on drying rack. If the "weak" negative is very valuable and cannot be replaced do not intensify by this method, for the life of the negative is usually shortened. Natural object negatives may have another fault, less common than weakness; some parts may be altogether too dense, so that a slide must be overprinted (and spoiled) in the shadows to have any detail in the high lights. This is more apt to take place with slow plates and underexposures. The cutting down of density is called reduction. Fortunately there are two classes of reducers; one destroys faint lines first, increasing contrast; the other, more useful, attacks the strong deposit in preference, diminishing contrast. Both reducers should be used with caution, as it is nearly as easy to ruin the negative as to improve it.

A good example of the first type is Farmer's reducer. The ingredients are Potassium Ferricyanide and ordinary plain Hypo solution. Potassium Ferricyanide does not keep well in solution; so it is best to dissolve it when needed and as the amount to be used is small and only "approximate", the balance may be neglected; add enough to two oz. of water to give a fair color; to this add two oz. of plain Hypo solution (fixing bath strength), immerse the wet plate and rock to insure evenness of action. Watch the reduction carefully and just before it "looks right", take out the plate, wash it well, put it in the fixing bath for a minute or two and then wash for 5 or 10 minutes.

The second reducer for lessening contrast, is made up as follows:

- (A) Ammonium Persulphate 15 grains.
Water 1 oz. (fl.)

This solution will not keep; it must be made up immediately before using and should be thrown away after the operation. Immerse the clean wet negative in a tray containing 3 or 4 oz. of (A), rock and examine (frequently) the treated plate; before the reduction seems complete, remove the plate and put it as soon as possible in another tray, containing:

- (B) Sodium Sulphite (dry) 1 oz.
Water 10 oz. (fl.)

Rock in (B) for two or three minutes, remove, wash for 5 minutes, and place on drying rack. Solution (B) may be used over and over again.

There are other reducers and different combinations making what is called a proportional reducer, giving uniform lessening of density without changing the contrast materially. This last is not needed for our use, as a longer exposure or an exposure to a stronger light when printing the slide, will have the same effect, as thinning down the negative.

Intensification and reduction may be used "locally" that is, applied to part of a negative only, by means of camel hair brushes and not by tray immersion. Local intensification, spotting and blocking out will be treated in the next issue.

FR. J. Brosnan, Weston, Mass.

ANALOGY BETWEEN A SEISMOGRAPH AND A RADIO RECEIVER.

Until you stop to think, it may strike you that the similarity between a seismograph and a radio-receiver is a little far-fetched, but upon further consideration it dawns upon you that the resemblance is more than superficial.

We might of course begin with a comparison of the wave motions themselves. Here, it would seem that there must be a divergence because the ether admits only a transverse wave, whereas the earth, an elastic medium to be sure, presents three, a longitudinal, a transverse, and a surface wave. The difference is not so great as it would seem because in the ether we have to have an equation that says it is incompressible, and that equation is nothing more than the expression for a longitudinal stress which has been set equal to zero, and inside the earth we do not have a surface wave to consider. We might pursue this into the properties of wave motion but the development is rather obvious and we are more interested in the instruments themselves.

A wireless receiver is an oscillating device which apart from detecting devices and accessories consists of three essential elements, an inductance, a capacity, and a resistance, or as we might say a sustaining element, a storing element, and a smothering element. When we have an excess of electrons on one plate of the condenser and a deficiency on the other, flow naturally takes place. The inductance serves to sustain the flow, and on account of this action, the flow does not stop at the first instant but continues until the sustaining power of the inductance is overcome by the back pressure due to the excess of electrons on the other side of the condenser. Then the process reverses. In the seismograph the sustaining element is the inertia of the pendulum, the storing element is the rise of a weight against gravity, or the strain of a spring, or the twist of a wire. Gravity, or the recoil of the spring, or the torque of the wire sets the boom in motion. The motion is sustained by the inertia of the boom, and thus carried past the equilibrium point, until the motion is arrested by the forces on the other side. In the radio receiver oscillation would never cease were it not for the resistance which more or less quickly dissipates the energy of the circuit. The seismograph would never come to rest were it not for the damping in the form of friction or otherwise that more or less quickly destroys the motion of the boom.

But the analogy does not stop with these fundamentals. When you turn the handle of your radio receiver, by adjusting the relation between inductance and capacity, you change the frequency of the circuit. While you do this you notice that the sound is at first faint, then when you get frequency of your set near that of the broadcaster it is quite loud, and then becomes very faint again. You have the same thing in the seismograph, except that the period of the instrument remains fixed and that of the incoming wave varies. The magnification of the seismograph varies the same way that the magnification varies in the radio set, so that the response of the seismograph is greatest when in tune, and the further the natural period of the seismograph is from the period of the incoming wave, the smaller the magnification. That is why it is necessary for a correct interpretation of a seismograph to measure the period of each wave in our record, to find its magnification from our tables or curves and to correct the trace amplitude for the variable magnification. As the preliminary waves are most important in the detection of distant earthquakes and as they generally have a period 10--12 seconds, the designers of the Milne-Shaw adopted 12 seconds for the period of their machine. Galitzin preferred to take the period of the surface waves 18--20 seconds for his instrument.

This variable magnification which gives so much trouble in a seismograph is a great virtue in a radio set and every effort is made to encourage it. Hence the reduction in the size of the antenna, the use of the indoor antenna, loose couplings. The idea is to make the set respond to as narrow a band as possible. With the seismograph we try to get as tight a coupling as possible, a concrete pier going down to bed rock making the frame of the machine as nearly as possible a part of the earth itself. Broadening the band of frequencies to which

an oscillating system is sensitive, or in other words decreasing the selectivity, is possible if we increase the smothering action, increase the resistance of the radio set, increase the damping of the seismograph. The effect of this procedure is two-fold. The band of frequencies through which a response is obtained is broadened. This represents a loss in selectivity, but a gain in sensitivity except for waves in tune. At the same time, a general flattening of the magnification curve takes place reducing the magnification. This is an advantage to the seismograph except for the loss in magnification, because the seismologist is not so much interested in tuning things out. In the earlier instruments, however, before the introduction of optical recording, the loss in magnification was too great a sacrifice. Now with the perfected methods of optical registration, we can afford to push the damping up until the system just ceases to oscillate.

In the radio set on the other hand it is selectivity and not broad sensitivity that is desired, low resistance wire is used. Braided wire is used. Connections are made as short as possible and kept tight by soldering. It is all to make the set as selective as possible, to make it sensitive to as narrow a band as possible.

In spite of all efforts to the contrary some selectivity is obtained in a seismograph. The speed of the paper means that vibrations that are too quick will be lost due to the thickness of the pencil or the overlapping of images where optical recording is employed. You have something similar to this in the limited sensitiveness of the diaphragm of your telephone receiver, or loud speaker. According to Galitzin quick vibrations are generally due to industrial operations and therefore not of interest in a natural science. If this is true, selectivity of this kind is a virtue in a seismograph. With regard to close earthquakes, Woods and Anderson regard even this much selectivity as a vice, and so they have designed a machine with a short period and a high paper speed.

It is the usual practice in radio reception to secure an increase in magnification or amplification, by connecting the first oscillating system to another through a transformer. In these sets there is more than one circuit to be tuned, but we have increased amplification with an increase in selectivity. Galitzin, to secure increased magnification does a similar thing, and he does not regard the increased selectivity as a disadvantage. On the end of the boom he has placed a coil that moving in a magnetic field generates a current. This current operates a galvanometer which is itself an oscillating system whose motion is recorded optically. There are here two circuits to be tuned just as in the radio set. Even the coupling is similar for a transformer consists essentially of two electric circuits linked by a magnetic circuit, whereas Galitzin's coupling consists essentially of two magnetic circuits linked by an electric circuit.

The resemblance between a seismograph and a radio set extends even to the defects. The howling and squawking of a radio set is the distortion produced by the internal oscillation of the set, and so it is precisely the distortion of the record by the proper action of the seismograph that creates the great problem for the makers of these instruments. And just as radio manufacturers quite justly insist that purity of tone is the greatest factor in deciding between one instrument and another, so Woods and Anderson appeal to the purity of the record as the crucial point to be settled in determining the superiority of one seismograph over another.

Dr. F. W. Sohn, Valkenburg, Holland.

THE AUDIFFREN PROCESS OF REFRIGERATION.

At 90 West St., New York City, there is located the Audiffren Refrigerating Machine Company. This is the American Branch of a French concern which, until comparatively recently, handled their American business through the Johns-Manville Company. Several years ago a Sales Agent of this latter company, in discussing his machine with one of the extern professors of Chemistry at Fordham, told a very interesting story regarding the origin of the apparatus.

The story as I got it, was something like the following.

A certain French Jesuit, named Audiffren, was engaged in teaching physics in a Jesuit school in some small French town. He was a dexterous technician, and invented and applied a clever device to illustrate to his class the principles of refrigeration. Though the apparatus was more or less of a toy, it also served a very practical purpose in that it proved an excellent means of cooling the wine for the Community Refectory. A short time later, however, some kind of a political rumpus occurred with the result that the Community of which Father Audiffren was a member lost their house and all their belongings. Now Father Audiffren had a brother, an extern, who besides being of a practical turn of mind also had a good legal training. This man, in taking an inventory of his brother's confused assets and liabilities, discovered the toy, saw the possibilities in commercializing it, and eventually put it on the market.

Such was the story, more or less, as I received it. The man who told it to me succeeded in obtaining two booklets from the Company describing the Audiffren System. In one of these booklets there appeared a picture of M. L'Abbe Audiffren. I then asked the Company to send me something of the history of their machine, but I never received an answer to my letter. They have been a bit skeptical of the S.J. after my name.

I then looked up the old catalogues of the French provinces, but was unable to find the name Audiffren in any of them. However, I did find the name of a certain Father Louis Audiffret, born Dec. 4, 1825, entered the Society in the province of Toulouse on September 2, 1869, and died at Toulouse on Sept. 14, 1891. But nowhere was he listed as professor of physics.

The machine, as far as I can ascertain, is very simple, efficient and satisfactory. I am told it is about as fool-proof as could be desired. The booklets, however, gave no hint as to the principle on which it works, except that in one place mention was made of sulfur dioxide. I have tried several times and from several different sources to get more information on it, but so far I have not been successful. Perhaps one of the readers of the BULLETIN can enlighten me, through its pages, both as to the history of the apparatus as also regarding its principle.

Mr. G.J. Shipley, Woodstock, Md.

SEISMOLOGICAL NOTES.

Congratulations to Georgetown on the acquisition of the only, (as far as I could find out) Galitzin on the North American Continent, -- and to Fordham on the completion of its Milne-Shaw equipment! Still heartier congratulations to both directors on the splendid upkeep of their stations and the lavish praise and recognition they are receiving on this side of the ocean.

The following problems might be use ful as suggesting lines of investigation in modest seismological research, and might serve those hunting a subject for an M.A. Essay at Washon or Woodstock, a Paper for next year's Science Association Meeting, or an Article for the BULLETIN.

1. POSSIBLE PREDICTION OF LARGE QUAKES. An examination of the large quakes of 1925 revealed the fact that a large quake is often heralded by several feeble shocks, occurring even a considerable time in advance, several years sometimes. To take an example: The quake of Aug. 7, 1925, with epicentre 30° E. 38° N. (suggested by Strasbourg), was preceded by the following series of smaller shocks at or near the same place--April 2, 1920, Nov. 13, 1918, June 19, 1918, June 13, 1918, Aug. 8, 1917, etc., all these shocks being feeble. The question naturally suggests itself--Would a study of these feeble anticipatory shocks give us any clue to the possible prediction of a man sized quake?

2. UNEXPLAINED PHENOMENON. On Sept. 20, 1920, a quake occurred at $20^{\circ} 6$ S. $168^{\circ} 8$ E. off Tonga Island at a sea depth of 3000 meters. The records of this quake are peculiar and have not been satisfactorily explained. Oxford, DeBilt and Paris, record activity at 15h. 20m. ca., while Uccle, Strasbourg, Stonyhurst

and other stations fail to record this activity but record one some ten minutes earlier. All however, agree in their record of the beginning of the quake. Why for instance should two such well equipped and equally well staffed stations as those of Uccle and DePilt (differing only one degree from the scene of the quake) behave so differently in their recording of it? The Uccle Director suggests that his activity, (ten minutes earlier than that of DePilt) is the activity of another quake. But this merely doubles the difficulty - Why did not DePilt record this activity even though it were that of another quake? And why did not Uccle record the later activity felt by stations all round it? I have the Uccle record of the quake before me and it is a perfect blank at 15h. 20m. while there is no mistaking the activity ten minutes earlier. What is the explanation of this different behaviour of the earth's motion at certain places? A study of the International Bulletin will show that this phenomenon is constantly occurring.

3. SUGGESTION FROM DOCTOR TURNER. Asked what he would suggest as the most useful piece of research on a modest scale in seismology just now, he replied: "A re-reading of the records of our stations, in the light of the data now published and almost up to date in the International Summary." When the present readings of our stations were made, the epicentre and time of origin of the quake had not been determined, and readings were to a certain extent made in the dark. Now both epicentre and time of occurrence have been fairly accurately determined, and a re-reading of the records in the light of this acquired data would yield profitable results. By re-reading, is not at all meant a correction of the readings formerly made, but additional notes of phenomena of importance not noted before, or the noted absence of phases that one would expect to find - peculiarities akin to that mentioned in the preceding paragraph. Doctor Rottle has started this re-reading at Strasbourg, and his interesting results may be found in the Travaux Scientifiques for 1925.

Mr. J. Lynce, Valkenburg, Holland.

NOTE ON SOME RECENT DEVELOPMENTS OF THE BOHR THEORY.

For some time past, there has been growing the conviction that, in spite of its phenomenal success in many lines, the Bohr theory as it stands is unable to face the facts. It meets with very serious difficulties when it attempts to get the intensities of spectral lines, the interpenetrating orbits it postulates, cannot seem to be made stable, it is baffled by the X-ray doublets, it cannot give a satisfactory model even of the helium atom, etc. About a half year ago, Heisenberg resolved to try to formulate the theory anew, dropping everything that was very uncertain, dropping also a physical picture of the atom, and using only the following: - the observed frequencies of the spectral lines, their intensities, and phases. He dropped the use of the orbital frequencies of the revolving electron entirely. With the aid of energy levels, one or two very simple quantum conditions, and the use of finite and infinite matrices, as his mathematical vehicle, he, with the aid of Born and others, has developed his theory so as to explain satisfactorily dispersion, the simple oscillator, the rotator in the circular orbit, etc. The theory, as far as it has been developed, for it is still in its infancy, gives all that the Bohr theory did, and succeeds in many cases where the Bohr theory did not. Bohr favors it; but in a letter to Nature some months ago said it heralded the failure of any attempt to get a physical picture of the atom, and that we must be content with the Heisenberg, Born mathematics. But as usual, just as soon as an eminent physicist despairs of a physical picture, and declares that we must abandon our ordinary mechanics and turn to mysterious forces, etc., he is promptly made aware that it is not safe to be so dogmatic. For, shortly afterwards, Uhlenbeck and Goudsmit came forward with the idea of a spinning electron, which had been suggested by Compton in 1921, but had met with no favor until now. With this spinning electron Uhlenbeck and Goudsmit, and Pauli also, have met with quite some success in the explanation physically of many of the formulae Lande and others have used quite arbitrarily in the explanation of the fine structure of spectral lines. The success of

Uhlenbeck is marred by the presence of a factor 2 in their results which should not be there, but Bichowsky and Urey, at Hopkins, now claim they have gotten over this difficulty. You see, therefore, that a new phase in atomic physics has commenced. I have not had the time to read the literature on the subject, especially since it is still in its infancy and laboring with the manipulation of finite and infinite matrices. Let's hope that it may dispense with its unyielding mathematical apparatus soon. Born, in his lectures on the subject at the University of California, hopes to be able to simplify the mathematics considerably before long.

I welcome the new idea heartily. In fact, at Hopkins, it was my firm conviction that either the proton or the electron was a magneton (which of course a spinning electron must be), and I wanted to make my research on an attempt to prove this experimentally, but was told it would be too ambitious a project for a beginner. May I venture another prophecy? If the spinning electron meets with success, it is only a step back to the vortex, and the vortex theory of matter may soon come back to its own.

If any one cares to read the present literature on the subject, here it is: Many other articles, however, will soon have to be added to the list, for the big mathematical physicists are all interested and at work on it:

Weisenberg, Zeitschrift für Physik, 33, p. 879, 1925.

Born and Jordan, " " " 34, p. 350, 1926.

Weisenberg, Born and Jordan, same, 37, p. 557, 1926.

Kramers, Physica, 5, p. 369, 1925.

Uhlenbeck and Goudsmit, Die Nat., Nov. 20, 1925.

" " " and Bohr, Nature, Feb. 20, 1926.

H.A. Compton, Journal Franklin Institute, 192, p. 145, 1921.

Bichowsky and Urey, Proc. Nat. Acad., Feb. 1926.

Father C.F. Deppermann.

A PROPOSED HALL OF ASTRONOMY IN NEW YORK.

The American Museum of Natural History of New York City is planning a large hall of Astronomy for students of all grades. During the summer of 1925 Dr. G. Clyde Fisher was sent abroad to visit observatories and similar institutions and to confer with their directors and other astronomers in order to obtain suggestions for the project. SCIENCE for January 22 contains an abstract of his report. One of the observatories visited was that of the Vatican. He discussed plans with the director, who as is well known, was for a number of years director of the Georgetown Observatory and did important work there on variable stars. He says: "The director of the Vatican Observatory, Father G. S. Lugin, who by the way is a naturalized American citizen, strongly recommended the installation of a small telescope which could be used by visitors for viewing objects in the sky. This would not be for professional astronomical work, however, as or institution should not be an observatory, but rather a museum of astronomy. The objective lens of this telescope need not be larger than five or six inches in diameter. The advice of Director Lugin is strengthened by the popularity of the so called 'Uranias' of Europe. I am convinced that this is an excellent proposal and hopes that place can be found for a small dome in which can be installed such a telescope."

Dr. Fisher gives an enthusiastic account of a projection Planetarium made by the famous Zeiss Optical Works of Jena. The first instrument of the kind was made for the astronomical museum at Munich. The second is mounted on the roof of one of the buildings of the Zeiss works. It consists of a hemispherical dome sixteen meters in diameter, capsule of seating about 280 persons. It is white inside and at the centre is a projection apparatus which throws on the inside surface images of the sun, moon, all the planets and some 4,500 fixed stars including the milky way. The projected images move just as the real bodies seem

to move in the heavens. By means of special projectors the names of the constellations can be shown on the sky. By means of a flashlight showing an arrow-pointed light any star or other heavenly body can be pointed out. Regular lectures are given, which are very popular. The mechanism is so perfectly designed that one imagines that one is outdoors under a clear night sky. A number of these planetaria have been sold to various German cities. One in Dusseldorf will have a dome thirty meters in diameter. If, as seems likely, such a large planetarium is to be erected in New York by the American Museum it should prove of great interest to the students of our various schools in the metropolis. Instructors of astronomy will find it worth while to take their students there to clarify their notions about the celestial sphere and to make them realize the various motions of the heavenly bodies. It may be noted that the preliminary astronomical hall of the Museum containing paintings and transparencies was opened on March 24.

FATHER MACELWANE FIRST CHAIRMAN OF THE NEWLY FOUNDED EASTERN SECTION OF THE SEISMOLOGICAL SOCIETY OF AMERICA.

The Seismological Society of America is a national organization having its headquarters in California. As eastern seismologists have found it difficult to take part in its meetings an eastern section was recently formed whose purpose is to arouse interest in earthquake study from every viewpoint. A quarterly bulletin will be published containing articles of interest to the layman as well as to the men of science. The first meeting will be held in Washington on May 1. Father J. B. Macelwane in charge of the central station of the Jesuit seismological association at St. Louis University who took an active part in the organization heads the list of temporary officers as chairman. Father Macelwane spent some time late in February studying the constants of the seismographs at Georgetown and Fordham. We were also glad to welcome him at Weston.

ANATOMICAL AND TECHNICAL MODELS.

Mr. J. Lynch of Valkenburg calls attention to a series of so-called models for instruction published by Pestalozzi Verlagsanstalt of Wiesbaden, Germany. They are sectional colored charts of the human body, the eye, head, etc., and also of engines motors, etc. They are moderate in price and should prove useful in class instruction. The fact that the descriptive matter and key are in German may perhaps lessen their usefulness in our schools.

OUR FORMER SECRETARY GRADUATING DEACON.

"Aus der Provinz" the German Province News for March informs us that Mr. Joseph Lynch, formerly professor of physics and director of the Seismological Observatory at Fordham University and Secretary of our Association, was among those ordained at Valkenburg on March 25. The BULLETIN sends its congratulations.

LECTURES ON SEISMOLOGY IN NEW ENGLAND.

On April 11, Father P.A. Tondorf of Georgetown University lectured in Boston on Earthquakes under the auspices of the Catholic Alumni Sodality. On the 9th. he visited Weston and gave the philosophers an illustrated lecture on the same subject. He also lectured in Providence on the 12th.

Mr. J. E. O'Connor Director of the Seismological Observatory at Fordham gave a lecture on Seismology at Holy Cross, Worcester, on March 19th.

LECTURE ON ST. PETER CANISIUS.

Mr. H. Hihler, Professor of Chemistry at St. Joseph's High School, Philadelphia, gave an illustrated lecture on St. Peter Canisius in Philadelphia in connection with the celebration of the canonization of the latest doctor of the Church.

NOTICE OF CHANGE OF ADDRESS. Subscribers of the BULLETIN are requested to notify the editor, Fr. H.M. Brock, Weston, Mass in due season of any change of address. Necessary corrections can then be made to our mailing list.

PHOTOGRAPHIC NOTES, No. V.

LOCAL INTENSIFICATION AND REDUCTION, SPOTTING AND BLOCKING OUT, ASSEMBLING OF NEGATIVES.

It may be necessary to strengthen one part of a negative without affecting the rest; such intensification is termed "local". This process calls for brushes and the ordinary intensifying solutions mentioned before. Brushes for local intensification, reduction, spotting and blocking out need not be the first class expensive ones required for slide coloring. Ordinary camel hair will answer very well; but have nothing to do with quill handles, buy wood-handled brushes, no.1 for small work, no.4 or no.6 for rougher touches. To intensify locally, have a small amount of the bichloride of mercury solution in a shallow cup, the dry negative lying flat up on a sheet of glass, 11" x 14", double thickness, supported almost horizontally, about 8 inches above a white reflecting surface. At the proper distance above the negative and parallel to it, set a 3 inch reading glass (2 mag.) in a ring-stand clamp; this will help the eye to guide the brush. Dip the small brush in the bichloride solution and begin the pointing with the edge of the area to be treated, prassing the brush on the film evenly and with a small circular motion. Be sure not to work the brush too long in one place, especially if the weather is hot and damp. For the brush point say out through the film and ruin the negative. The bichloride solution will soften the silver deposit and when all the parts to be locally intensified are painted with the mercury salt, hold the plate under a strong quick stream of water for a minute or so, to wash off the excess bichloride and prevent it from overrunning its place. Then leave the plate in a tray of running water, for about 10 minutes, and change to a tray of the regular ammonia solution. The whitened parts become a strong black, the other parts are not affected by the ammonia. Then remove the plate, wash for 5 minutes and set aside to dry.

LOCAL REDUCTION. We have already spoken of the reduction of the strong parts of a negative, in preference to the weak, by a general application of an ammonium persulphate solution. By "local reduction" here, we mean the complete elimination of silver deposit, strong or weak, from selected parts of the plate. Use the same horizontal support, magnifying glass and brushes as before; make a small amount of potassium ferricyanide solution (about $\frac{1}{2}$ oz), strong enough to have the color of light near-blue; to this add $\frac{1}{4}$ oz. of fresh plain hypo solution (negative strength). With this mixture paint, over and over again, on the dry negative, the parts of the silver deposit to be "cut out", and try to do the work without waste of time, or the ferricyanide may produce undesirable stains. When the required disappearance of silver has been effected, hold the plate for a minute under a strong water stream, immerse for a few minutes in the plate hypo, wash for 10 minutes and set aside to dry.

SPOTTING AND BLOCKING OUT. To carry out these operations properly, one should have a "restocking stand", which will be used later on for a coloring stand also. This consists of a horizontal wooden base, about 11" x 14", covered

with white cardboard; a frame, same size, hinged to the base and raised to an angle of 45 degrees, carries an 11 x 14 piece of heavy glass. The negative to be treated is placed on the glass plate, with the ring-stand magnifying glass ready if needed. The negative may have pinholes, larger defects, text or other diagrams not wanted on the slide; these must be all blocked out. The most convenient blocking medium is Gihon's opaque, to be applied mainly to the film side of the negative. Uncover the opaque cake, wet its surface with water and "work it up" with a brush until the mixture is thick enough to leave an opaque mark over a scratch on the film. Don't make the "paint" too thick, for it may "craze" on drying and besides it might prevent good contact between the negative and the positive plate in the actual slide printing. Cover all the defects, unnecessary text, etc., with a thin smooth layer of opaque and when the work has dried, examine it for drying cracks and retouch. If the blocking out runs very close to any line, regular or irregular, it is difficult to make a neat or accurate "fit" with a thick material like opaque. In this case use a concentrated solution of Methyl Orange or Tropaeolin Orange in water, with a few drops of grain alcohol added to help the solvent power. With the aid of the magnifying glass, and using a nicely pointed, well-filled brush, one can, with a little practice, lay the color exactly in contact with any line, straight or curved. Once the "fitting" has been made with the orange dye, opaque may be used for the rest of the job.

ASSEMBLING NEGATIVES. Sometimes it may be convenient or necessary to put on one slide 3 or 4 diagrams from different parts of the same book; the book should not be spoiled by cutting out the pages and making one "copy", so the proper method is to take separate negatives and group them for camera reduction or contact printing. Usually the grouping of more than two negative will be easier for reduction by camera. Having made the negatives and before spotting or retouching, place them all face down on the glass plate of the retouching stand. Examine them to see how much superfluous glass may be cut away in order to bring the diagrams close together. The nearer they are, the less waste space there is on the slide and the larger will each part be on the screen. Then with a diamond or steel wheel glass-cutter, trim the negatives; set the pieces face down on the retouching stand, and square them up with regard to each other in a group whose vertical diameter should not, if possible, exceed its horizontal. This squaring up will be helped by inserting between the cut parts, very small bits of wood (match sticks). Then take pieces of lantern slide binding strips and pasting them over the cuts on the upturned glass side, fasten the parts together; cover all the separating cuts with this gummed paper. Carefully turn over the unified group and stiffen it by pasting strips over the cuts on the gelatine side; touch out any defects with opaque and the assembled negative is ready for camera reduction. It may happen that the members of the group vary in intensity; this may easily be cared for by varying the exposure, to be described later on. If the group is small enough for contact printing, do not paste any strips on the gelatine side, (this would produce parallax in the contact printing). Be sure, when the assembled group is lying face down on the glass support that the backs of all the parts lie in the same plane parallel to the gelatine face. The different parts may have different thicknesses; so build up the thin ones to the proper level by superposed strips of binding paper on the glass side, so that when the group is put in the printing frame, pressure on the gelatine side will affect all parts equally. We are now approaching the actual making of the slide.

Fr. J. Brosnan,
Weston, Mass.

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ADVANTAGES OF THE FAHRENHEIT THERMOMETER.

The advantages of the Centigrade thermometer are so obvious that one wonders why its use is not adopted in the United States. A short article in the Monthly Weather Review (April 1916, p.205) gives some reasons why the Fahrenheit thermometer is retained, and, as this thermometer is still in use, these reasons

have prevailed. The article in question is an excerpt from the report of the annual meeting of the National Academy of Sciences, held in Washington April 17 to 19, 1916. (Cf. Proc., Nat'l Acad. Sci., May, 1916, v.2, No.5, p.304). The excerpt starts thus: "A report of the committee of the National Academy of Sciences on bill H.R.528, discontinuing the use of the Fahrenheit thermometer scale in Government publications, etc." Then part of the text is given, from which I copy the following:

"It must be recognized that considerable initial expense must be incurred by the United States Weather Bureau in changing its apparatus to conform to the proposed act. Furthermore, on account of the more open scale of the centigrade system that bureau will be subject to a continued increased cost of publication, owing to the necessity of printing the first decimal place in order to maintain the present accuracy. The use of negative temperatures and minus signs entails greater liability to errors and more clerical labor would be required in checking the accuracy of the reports of cooperative observers of the Weather Bureau and in computing monthly and other mean temperatures. Notwithstanding the foregoing, the academy is in favor of legislation to make the centigrade scale of temperatures the standard in publications of the United States Government, etc."

If only one glance be given to the "Climatological Data" published by the Weather Bureau, the validity of these objections to the change will be easily appreciated. The fact that, in spite of the recommendation of the committee, the measure was not passed, goes to show the strength of argument from dollars and cents.

Mr. B. Doucette,
Manila, P.I.

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THE OBSERVATION OF EARTH CURRENTS AT THE OBSERVATORY OF THE EBRO.

Fr. Ignatius Puig, Assistant Director of the Observatory of the Ebro, Tortose, Spain, has two articles on Earth Currents in "Iberica" for March 27 and April 3. He discusses very interestingly the nature and registration of these currents and gives some idea of what is being done at Tortose in this line.

The Observatory of the Ebro has the distinction of having the longest and most complete record of Earth Currents of any observatory in the world. Since its foundation in 1905 until the present day it has made daily observations which are preserved in some 7000 photographic records. This far outdistances anything done elsewhere, for the work next in importance is that done by Weinstein in Berlin from 1884-1887. Only lately has the Carnegie Institution set up stations at Huancayo, Peru and Watheroo, Australia.

The credit for the work done at Tortose is due in large part to Fr. Juan Garcia Molla, at present Editor of Iberica, who for many years was director of the Electrical section of the Observatory and whose Memorial "La Seccion Electrica" (1909) merited the following words of praise from Dr. Matthias in his work, "Traite d'electricite atmospherique et tellurique" (1924): "This publication is a model of clearness, of conscientiousness and of scientific probity". The same authority speaking of the French translation of the Fr. Molla's work says: "It is the first publication in French on terrestrial electricity at a time when this field was completely in the hands of Germans".

The success of the Ebro Observatory in this field is also due to its fine location and equipment. As to the former it is situated apart from any high-voltage electric lines which are the greatest impediment to the observation of Earth Currents. Regarding the latter, Fr. Puig gives a full description of the plant both exterior and interior, as he divides it. The first consists on two lines, N-S and E-W, 1415 and 1280 meters respectively in length. An interesting feature of the lines is a home-made lightning arrester so necessary for the safe operation of the apparatus. The interior installation consists of two Despretz-D'Arsonval galvanometers which record photographically.

In conclusion it might be well to cite a few testimonies of notes scientists regarding the Observatory of the Ebro and its work. Bosler, director of the

Marseilles Observatory says (1924): "The Observatory of the Ebro is the station from which we have the most recent and most trustworthy data". Stenquist (1925): "Since the beginning of the year 1910 the Observatory of the Ebro, belonging to the Jesuits, has been publishing a series of observations on earth currents of great value". Dr. Louis A. Bauer, head of the Magnetic Department of the Carnegie Institution, in an article in "Terrestrial Magnetism and Atmospheric Electricity" (1922) writes: There is only one observatory where in recent years systematic observations on earth currents have been carried on, namely, the Observatory of the Ebro, Tortosa, Spain. Here a very valuable collection of records for the years 1910-1920 has been obtained".

Mr. P. Yancey,
Woodstock, Md.

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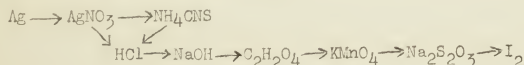
CHEMICAL NOTES.

1. Volumetric Standards. Standardization of Volumetric solutions, as is known, varies with the reference material against which the given solution is to be checked. Such reference material, usually called the "Standard" has been agreed on more or less universally only in recent years. Some prefer a different standard for each solution to be standardized, e.g. Fe for KMnO_4 , I_2 for $\text{Na}_2\text{S}_2\text{O}_5$, etc. But besides being inconvenient, it would be an almost hopeless task to establish the required purity of each one of these standards. Analysts have therefore settled on certain few "Primary Standards" and against these, check their other "Secondary Standards".

Here in the U.S. we have three Standards which are available in a high state of purity. First, pure metallic Silver, from the U.S. Mint at Philadelphia. Second, Benzoic Acid (for acidimetry and alkalimetry). Third, Sodium Oxalate, for Oxidimetry. Both the latter, of "Certified Purity" are furnished by the Bureau of Standards, Washington, D.C. And all three are obtainable at a very reasonable price.

Representative samples for practically all types of Quantitative analytical work can also be obtained from the Bureau of Standards. These samples bear the analysis of one of the Bureau's Chemists, and are really the last word in this work.

2. Silver as a single primary standard has been proposed by certain Analysts as the ultimate reference material for practically all volumetric work according to the following scheme:



However not everyone is in agreement on such a system.

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Most of the following books are well known, but using them more or less frequently as recognized texts or reference books, I thought it might be profitable to collect them all in one group, for the benefit of those who might not enjoy large library facilities. They may take up a good deal of space, but I think they will make "good threads for the loom".

Quantitative Analysis:

For both theory and practice, Inorganic Quantitative Analysis, by Fales, The Century Co., N.Y., 1925.

For modern theory, Theory of Quantitative Analysis, by Henry Basset, Published by George Routledge and Sons, London, 1925.

Physical Chemistry:

Texts: Millard, Getman, Washburn, Eucken. The latter bears the title: Fundamentals of Physical Chemistry, Eucken, trans. by Jette and La Mer, McGraw Hill, 1925. It is an extremely comprehensive text, but rather mathematical.

Reference: W. McEwen, A System of Physical Chemistry, 2 Vols. (applying the Quantum Theory to Physical Chemistry) Longmans Green and Co.
Taylor, Hugh S. Treatise of Physical Chemistry 2 Vols. D. Van Nostrand.
Dr. Taylor is a Catholic and Professor of Physical Chemistry at Princeton. This treatise is praised very highly. It is a compilation for which the best chemists of the day have written.

Physical Chemistry Laboratory Manuals, and Special Topics:

Thermodynamics, Theory, Lewis and Randall, McGraw Hill.

Thermodynamics, Problems. Some few are given in the above. The best collection (well graded) is given in Partington, Chemical Thermodynamics and Applications, Constable and Co., London, 1924.

Also Noyes and Sherrill, Chemical Principles, Macmillan, 1923. This book supposes a good teacher, as it affords few "crutches".

H-Ion Determination; by Clarke, publ. by Williams and Wilkins, Baltimore.

Atomic Structure; Foote and Mohler, The Origin of Spectra. Also

Andrade, Structure of the Atom, G. Bell and Sons, London, 1924
Bohr, The Theory of Spectra and Atomic Constitution, Cambridge University Press, (about 1921).

Sommerfeld, Atomic Structure and Spectral Lines, Methuen, London.

This has been called the masterpiece on the subject.

See also: Eucken, (above) last chapter; and Taylor (above), vol. 1, chap. 1, and Vol. 2, c. 16.

Isotopes, Acton, publ. by Edward Arnold, London.

Phase Rule, Findlay.

Colloids, Freundlich. (I do not know whether this has been translated from the German). Original title, Kapillarchemie.

Kinetics, cf. Article in Taylor, Homogeneous Equilibria in Solution, by F. O. Rice, a Catholic, trained by the Jesuits in Liverpool, and now Professor at John Hopkins.

Problems in Physical Chemistry:

Noyes and Sherrill, (see above).

Physico-Chemical Calculations, John Knox, Methuen, London, 1911.

Chemical Statics and Dynamics, J.W. Mellor, also an old book, 1904.

Laboratory Manuals:

Sherrill, Laboratory Experiments in Physical Chemistry, Macmillan.

Findlay, Practical Physical Chemistry, Longmans.

Nennst, (whose translator and publisher I do not recall).

N.B.--The above are thought very well of and used daily at Hppkins. The list is not comprehensive, at all, but may be useful to some.

Fr. J. Sullivan,

John Hopkins University,
Baltimore, Md.

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MEETING OF THE NEW ENGLAND ASSOCIATION OF CHEMISTRY TEACHERS AT BOSTON COLLEGE.

A year ago we chronicled the very successful meeting of the New England Association of Physics Teachers which took place at Boston College on March 28, 1925. All were delighted with the hospitality extended to them by the college and by the excellent facilities provided by the magnificent new Science Building on University Heights. It is not surprising therefore that the New England Association of Chemistry Teachers also chose Boston College as the scene of its 100th meeting on May 1, 1926. Fr. A. Hohman, professor of Chemistry was a member of the committee in charge and also made the necessary arrangements at the college.



The business meeting began at 9:30 with Mr. Leslie C. Johnson presiding. This was followed by an address of welcome by Fr. James H. Dolan, the president of the College. The principal morning lecture was by Fr. J. Brosnan of Weston on "Methods and Results of Natural Color Photography with Hints for Color Slides in Science Teaching". Other papers presented were "The Contribution of Chemistry to Medicine" by Dr. C. E. Bolser of Dartmouth College and "Organic Chemistry and its Relation to Industry" by Dr. C.H.Horty of New York, President of the National Organic Chemical Manufacturers' Association. Professor H.F.Davidson of Brown University who was to have read a paper on a "New Lecture Table Demonstration" died quite suddenly three days before the meeting. A committee under the leadership of Dr. L. Newell of Boston University prepared resolutions of sympathy which were adopted by the Association. About 75 attended the meeting including Fr. G. Strohaber and some of the staff of the Department of Chemistry of Holy Cross College.

MEETING OF THE AMERICAN GEOPHYSICAL UNION.

The annual meeting of the American Geophysical Union was held at the National Academy of Sciences, Washington, D.C., on Friday, April 30. The general meeting was held at 2:30 P.M., the sections of Geodesy, Seismology, Meteorology, Terrestrial Magnetism and Electricity, Oceanography and Volcanology meetings in the morning. There were three of members of the Society present, Frs. Macelwane and Repetti of St. Louis and Fr. Tondorf of Georgetown. Fr. Macelwane read a paper on his new seismological tables and Fr. Tondorf took part in several of the discussions. Fr. Macelwane was elected a member of the Union, which now has two Jesuits as members, Fr. Tondorf Having been elected two years ago. The membership of the Union is limited.

FIRST MEETING OF THE EASTERN SECTION OF THE SEISMOLOGICAL SOCIETY OF AMERICA.

In our last number we mentioned the formation of an Eastern Section of the Seismological Society of America of which Fr. Macelwane of St. Louis was the first chairman. The first meeting was held in Washington on May 1, 1926. There was a symposium on "The Present Status of Seismology in the United States" in which Fr. Macelwane took part, his subject being "The Jesuit Stations in the United States--a Retrospect". According to Science for May 14, Fr. Macelwane was elected chairman of the Eastern Section, with E. A. Hodgson vice-chairman and Commander Heck, secretary-treasurer.

A recent letter of the secretary Commander Heck states that "the purpose of the Section is to arouse interest in earthquake study from every viewpoint:--from that of the business man, architect and engineer and those who benefit by their work, the insurance companies and the insured, those studying the earthquake danger in large cities as well as those interested in the study of earthquakes as geologists and seismologists". The present wide-spread interest in earthquakes not only on the part of men of science but also on the part of business men, insurance men and the general public is a remarkable phenomenon. It is a proof of the timeliness of the recent organization of the Jesuit Seismological Association. Our opportunities in this developing world science are unique. We have every incentive to labor for results of scientific value.

SYMPOSIUM ON EARTHQUAKES AT THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

Another proof of the interest shown in earthquake phenomena is the recent symposium on earthquakes held at the 933d meeting of the Philosophical Society of Washington on March 6, 1926. Fr. Tondorf of Georgetown took a prominent part. His subject was "Seismology--a Retrospect". Other papers were "Outstanding Problems in Seismology" by Commander Heck, "Earthquakes from the Isostatic Viewpoint" by Dr. W. Bowie and "Difficulties in the Study of Local Earth Movements" by Dr. A. Day. The papers were published in the Journal of the Washington Academy of Sciences for May 4, 1926.

On May 8, Fr. Tondorf also addressed the University Club of Washington on "Earthquakes and Their Results". The other speaker was Dr. Bailey Willis, the President of the Seismological Society of America.

NOTE ON FATHER ALGUE.

We have already mentioned the recent resignation of Fr. Algue as Director of the Weather Bureau of the Philippine Islands after many years of distinguished service for the Church and its missions, for science and navigation. Fr. Tondorf calls our attention to the following note which appeared in the Monthly Weather Review for December 1925. It is worthy of a place in the BULLETIN as the Review is in reality the official organ of the United States Weather Bureau. The note follows:

"Resignation of Father Algue from the Philippine Weather Bureau.

We have received the following note from Sr. Miguel Selga, Acting Director, under date of December 7, 1925:

I regret to announce the resignation of Rev. Jose Algue, as Director of the Weather Bureau of the Philippine Islands, effective December 31, 1925. Father Algue left Manila for Spain on September 14, 1924; poor health and failing eyesight prompted his resignation.

"The above note indicates the withdrawal from active service of a distinguished meteorologist. Father Algue went to the Manila Observatory some 30 years ago from Habana, and subsequently became its director. In this capacity in 1900 he reorganized the weather service of the Philippines, inaugurating the use of methods and apparatus in accordance with the practice of the U. S. Weather Bureau. From that time, the record of the Philippine Weather Bureau under his guidance has been one of increasingly important service, particularly in the study and forecasting of tropical hurricanes in that part of the world. Father Algue's great contribution to the literature of tropical storms is his well-known "Cyclones of the Far East" published in Manila in 1904."

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GRADUATE FELLOWSHIPS IN CHEMISTRY AT HOLY CROSS COLLEGE, WORCESTER.

"The Tomahawk", the Holy Cross Weekly on May 11, 1926 announced the recent establishment of six graduate fellowships in Chemistry open to properly qualified graduates of colleges and technical schools. Appointment to the position of fellow is for the period of ten months beginning on August 15, 1926. Fellows are required to become candidates for the degree of Master of Science. In addition to study and research they will devote a maximum of twelve hours a week to instruction in the Department of Chemistry.

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COURSE IN SUGAR CHEMISTRY AT THE ATENEO, MANILA

A neat booklet entitled "Sugar Chemistry or Sugar Factory Control" has been published by Fr. R. E. Schmitt, professor of Chemistry at the Ateneo, Manila. It describes the new course in Sugar Chemistry inaugurated at the Ateneo. It is stated that the object of the course is to give the student an understanding of the various chemical processes and methods employed in Sugar Centrals to extract the sugar grain from the cane. The chemical technology of sugar extraction will be investigated from the time the cane enters the factory until the sugar grain is stored in the warehouse. The laboratory work will include the study of the methods employed for the quantitative analysis of the products used and obtained in sugar manufacture. This would seem to be a very timely course for our Manila students on account of the importance of the sugar industry in the Islands and we congratulate Fr. Schmitt on its inception.

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ANOTHER NOTE ON THE WESTON STANDARD CELL.

We recently received a letter from Fr. Vittrant of the Province of Paris, Professor of Physics at the Université L'Aurore at Shanghai, China. It will be remembered that he contributed an article in Vol. 2, no. 4 on the unification of the units of measurement in the United States, the British Empire and China. He says that he was interested in the note in our last number on the constancy of the Weston Standard Cell and gives some of his own experiences. "I have not yet purchased any Weston Cells as I feared the effect of the long voyage on them. However, in May 1921 I made up two cells at intervals of ten days. They are of the saturated type, there being an excess of cadmium sulphate crystals. Their design is such that they have a large internal resistance, over 1000 ohms. I always compare them before and after any experiment in which they are used. I have never found a difference of more than 0.00014 volts between them. In fact this difference is exceptional. In general the difference does not exceed 0.00007 volts. In January 1925 I compared them with a Standard cell imported from France for another laboratory. The one with the larger electromotive force exceeded this by 0.00015 volts, the other by only 0.00007 volts. I am therefore in no hurry to purchase other standards". This observation is interesting as it shows how reliable and constant the Weston cell is, even when it is made up on the laboratory.

NEW SEISMOLOGICAL STATION AT THE CENTRAL STATION OF THE JESUIT SEISMOLOGICAL ASSOCIATION.

"Science" for June 4, announces that Major M.J. Connolly of Washington D.C. has given \$15,000 to St. Louis University to build and equip a first seismographic station for the study of both local and distant earthquake shocks. The Missouri Physics Bulletin for June 1926 states that the station will be built, not in the city of St. Louis, but at Florissant some distance from the buildings at St. Stanislaus. "The equipment will consist of two short period Wood-Anderson torsion Seismometers for the measurement of the horizontal components of motion in near earthquakes, one short period vertical component torsion seismometer of the same type, two long period torsion seismometers for distant earthquakes and, if possible, a Gallitzin long period vertical for distant earthquakes, all to have recording drums driven by an oscillator, synchronous-motor system of the highest precision and using only photographic registration. The \$15,000 will pay only for the cost of construction and equipment and will furnish nothing for the upkeep".

Those who are interested in the Wood-Anderson instruments mentioned above, will find a description and discussion of the theory in the "Journal of Optical Society of America" June 1924, and in the Bulletin of the Seismological Society of America" March 1925.

GRANT TO FATHER LEJAY.

"Science" for May 28 states that Father Lejay of the Zi-ka-wei Observatory Shanghai, China, has received a grant of 4000 francs from the French Academy of Sciences to enable him to complete his investigations of atmospheric electricity.

FRENCH JESUIT PRESIDENT OF THE FRENCH GEOLOGICAL SOCIETY.

We read in the London Tablet for May 29 that Father Teilhard de Chardin of the Province of Lyons who is professor of Geology at the Institut Catholique of Paris is now president of the French Geological Society. It states also that he has gone to Tibet and Mongolia in company with Fathers Lejay and Licent on a scientific expedition under the auspices of the French Government. The BULLETIN was indebted to Father Teilhard de Chardin for the list of French instrument makers which appeared in Vol. 2, no. 5. We congratulate him on the high honor which has come to him.

NEW REFERENCE WORK ON PHYSICS.

Our professors of Physics will be interested in a new and quite elaborate

Handbuch der Experimental Physik which has recently been announced. It is edited by Dr. Wien of Munich and Dr. Harms of Wurzburg, and published by the Akademische Verlagsgesellschaft of Leipzig. It will consist of a large number of volumes,--we don't know just how many--prepared by German physicists of standing and, being encyclopedic in its nature, should prove very valuable as a book of reference.

It will doubtless replace the well known work of Winkelmann. It is claimed that it will be the most complete and most important handbook which has ever been published on experimental physics. One volume of about 350 pages neatly printed has already appeared. It is "The Mechanics of a material particle and of rigid bodies" by Professor Haas of the University of Vienna. The work may be ordered from the Buchhandlung Gustav Fock, Schlossgasse 7-9, Leipzig, Germany.

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SUMMER MEETING OF THE EASTERN SECTION OF THE AMERICAN ASSOCIATION OF JESUIT SCIENTISTS.

The annual meeting of our Association under the presidency of Fr. G. Strhaver of Holy Cross College will take place next August at Georgetown University, Washington, D.C., after the Science Summer School. The latter will have its sessions at Holy Cross College. The advantages of the national capital for a meeting of this kind are so well known that they need not be enumerated. Many of the most important scientific institutions of the United States Government are located there. Our oldest Catholic University with the many associations connected with the early days of the restored Society in this country is famed for its hospitality and has ample facilities for entertaining members and for providing lecture rooms and equipment for papers and demonstrations. Its proximity to Woodstock will make it possible, we understand, for many of the Theologians to attend. The vice-presidents of the sections have sent out notices urging attendance and the preparation of papers. Exact dates and other necessary details will be announced later. It is to be hoped that all who possibly can will arrange to be present, and take an active part in the sessions. Let each one be assured that the success of the meeting will depend in due measure upon his cooperation. Mark your Ordo or Calendar now and let nothing stand in the way. We have the cordial approval of the Superiors of both Maryland-New York and of New England.

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CORRECTION. Fr. W. Repetti calls our attention to a slight error which crept into Mr. Doucette's article on the Equipment of the Manila Observatory in our last number. It is stated that there is a Secchi Universal Meteorograph similar to the one at Manila in our College in Cincinnati. The instrument is in Father Odenbach's Observatory at John Carroll University in Cleveland.

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ORDINATIONS AT WOODSTOCK.

The BULLETIN extends hearty congratulations to the members of the Association who were raised to the dignity of the priesthood at Woodstock this month. They are Fathers Butler, Kelly, McWilliams, Reith, Shiple, Brown and Higgins. Father Lynch will be ordained at Valkenburg. The BULLETIN is especially indebted to Father Shiple for his zeal and devotedness in taking care of all printing for the past three years. He has made many of the stencil sheets himself and he has enlisted the enthusiastic cooperation of others in this laborious work and in the printing and mailing.

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In closing this year's volume the BULLETIN wishes to thank all who have helped to make it a success. It appreciates deeply the interest shown by those who have contributed articles and notes and also the good work done in printing the different numbers by the theologians of Woodstock.

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NOTICE OF CHANGE OF ADDRESS. Subscribers to the BULLETIN are again requested to notify the editor, Fr. H. Brock, Weston, Mass., of any change of address the summer may bring them. We wish to keep our mailing list up to date.

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